SPECIAL HANDLING

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PROPOSAL FOR THE STUDY OF OPTIMUM PARAMETERS

FOR BB-400 AND ASSOCIATED EQUIPMENT

February 9, 1962

SPECIAL HANDLING

TECHNICAL PROPOSAL

[redacted] is proposing a study program coupled with the establishment of necessary testing facilities to establish the optimum parameters for the cathode ray tube, fiber optics, and film system of the AN/APQ-93 recorder. A critical element affecting performance of the AN/APQ-93 program is the electro-optical-photographic transducer of the recorder; some components of which are pushing the state of the art. STAT

[redacted] proposes that the program of study be directed to the problems whose solution is necessary to the success of the test program. Essentially these major problems require the evaluation of available cathode ray tubes for resolution and light output; the study of fiber optics to ensure maximum resolution, contrast, and correct geometrical rendition of the display; and evaluation of photographic film whose sensitometric characteristics along with spatial frequency response affect the overall performance of the recorder. STAT

Also, continuing liaison with manufacturers of these parts of the system will be maintained to expedite the procurement of the components required for the recorder optical-photographic system. We are highly dependent on the development activities of the manufacturers to solve the problems inherent in the system. It is important that a continuous contact be maintained to ensure their continued efforts in the solution of the technical problems encountered in the fabrication of the recorder system.

The cathode ray tube, fiber optic array, and film must be tested as a complete assembly. For this phase we propose the construction of a test facility which will permit the evaluation of the individual components as a part of the overall system.

At the present time [redacted] has a facility for the testing of high resolution cathode ray tubes. However, facilities for testing the cathode ray tube, fiber optic array and photographic film as a system will require the construction of further facilities. STAT

This test facility will require the following components:

Equipment for mounting the cathode ray tube and fiber array assembly along with a method of transporting film across the fiber array.

Scanning and pulse circuitry to provide deflection signals to cathode ray tube.

Test signal generators for the evaluation of resolution, geometrical linearity, transfer function linearity and for sensitometric evaluation of the photographic films.

Film transport mechanism as mentioned above. It is not required that this mechanism have the same high degree of speed constancy as is required for the recorder, since resolution and sensitometric measurements can be made disregarding the effects of speed variation in the film drive. The transport will be designed to permit various standard widths of film, i.e., 35 mm, 70 mm, 5 inch and 9 inch film to be used interchangeably since certain film emulsions are more readily available in one size than another.

[redacted] cathode ray tube testing facility which is STAT
now in operation at our [redacted] plant includes a flying spot test STAT
signal generator. The flying spot scans a transparency of a standard television test pattern, generating a video signal. The signal is fed to the cathode ray tube, which is mounted in a universal tube mount capable of accepting a variety of display tubes, through a twenty megacycle amplifier chain.

Since a cathode ray tube with a one mil or one-half mil spot is capable of resolving all the detail in the television test pattern at full scan, we find the limiting resolution of the tube by shrinking the scan until the 800 tv line pattern cannot be resolved. By measuring the height of the pattern at this setting and dividing this by the number of tv lines still resolved, then finding the reciprocal, we compute the width of the spot.

With this test set we will measure the limiting resolution of the cathode ray tube before it is assembled with the fiber optic array. The resolution of the combined fiber array and tube, however, cannot be measured so simply. It is necessary to generate a dot or line pattern display on the CRT and to record this pattern on film to measure the response. Also it is required to move the film past the single line scan on the end of the fiber array.

Our proposed test set will provide means to mount the cathode ray tube and fiber array with a film transport. To generate the required signals for testing, we will construct a resolution test set. This set will generate frequencies locked to the scanning rate of the CRT deflection system ranging from 1 megacycle to 40 megacycles. We have already constructed a similar set with output frequencies up to 15 megacycles. However, its output is limited to approximately two or three volts which is not sufficient to drive the grid of the CRT. The proposed set will generate twenty volts of signal which can be applied directly to the CRT grid.

Film exposed to the signal will be processed and read on a microdensitometer, already a part of [redacted] facilities.

This equipment will be capable of measuring the overall frequency response of the cathode ray tube, fibers and film. As the work progresses, we will test various film emulsions to determine the optimum conditions for linear transfer of the input signal as a function of the transmission of the film record.

It must be pointed out that the AN/APQ-93 recorder as designed by [redacted] is capable of performing the mechanical functions of most of the proposed tests. However, the expense of fabricating a recorder solely for the proposed testing program is prohibitive. Our proposed test set will provide a more economical and flexible means of performing the required tests which will lead to optimum performance for the AN/APQ-93 recorder. The purchase of special CRT's and fiber optics are not a part of this program. The components to be tested will be those acquired for the construction of the recorder, or furnished as samples for testing. Therefore, no provision in the cost estimate has been made for the purchase of these components.

To summarize the proposed program:

Phase I -- Construction of a special test set for testing of the cathode ray tube, fiber optic, film assembly. Liaison with manufacturers of components.

Phase II -- As components of the assembly are delivered, testing as individual components and also in assembly. Preparation of reports of each test will be submitted.

Delivery schedule:

Phase I -- $1\frac{1}{2}$ months after authorization to proceed.

Phase II -- $4\frac{1}{2}$ months after completion of Phase I.